RX Family

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Retrieve Recommend Operation of INFABT Occurrence in The Ethernet Controller

Introduction

This document explains one of the recommend recover operation after when INFABT event was occurred using the Ethernet and EPTPC Firmware Integration Technology modules. This example also can be used as the reference to Renesas Technical Update [1].

Target Device

This example supports the following device.

- RX64M Group
- RX71M Group

When using this application note with other Renesas MCUs, careful evaluation is recommended after making modifications to comply with the alternate MCU.

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1. Overview

This document explains one of the recommend recover operation after when INFABT[1] event was occurred using the Ethernet and EPTPC Firmware Integration Technology (FIT). This example checks the occurrence of the INFABT event constantly with receiving the frames from other communication devices. When INFABT event was detected, this example disables the interrupt from the EPTPC, closes the ETHERC and EDMAC, and resets the EPTPC properly. Thereafter, this example does the initialization process and makes the ETHERC and EDMAC to enable frame transfer again. The target frame format is only restricted to the Ethernet standard one in this example, though this retrieve operation also need to be the PTP frame [2]. In detail, please refer to Sec 2.4. Users can implement initialize and retrieve operations to their own system refer to this example.

[1] Time Control Information Abnormality Detection Flag.

1.1 Retrieve Recommend Operation of The INFABT Occurrence in The Ethernet Controller

This module is implemented in a project and used as the operation example after when INFABT event was occurred.

1.2 Related documents

[1] Notes on Using Ethernet Controller, Rev.1.00, Renesas Technical Update (TN-RX*-A125A/E), May 25, 2015

[2] IEEE Standard for a Precision Clock Synchronization Protocol for Networked Measurement and Control Systems, Revision of IEEE Std 1588-2008, Mar 2008

[3] RX Family Ethernet Module Using Firmware Integration Technology, Rev.1.02, Document No. R01AN2009EJ0102, Mar 27, 2015

[4] RX Family EPTPC Module Using Firmware Integration Technology, Rev.1.02, Document No. R01AN1943EJ0102, Dec 31, 2014

[5] RX Family TCP/IP for Embedded system M3S-T4-Tiny Module Firmware Integration Technology, Rev.2.02, Document No. R20AN0051EJ0202, Jan 05, 2015

[6] Renesas Starter Kit+ for RX64M, User's Manual

1.3 Hardware Structure

The Ethernet peripheral modules of the RX64M/71M group are composed of the EPTPC, the PTP Host interface peripheral module (PTPEDMAC), dual channel Ethernet MAC ones (ETHERC (CH0), ETHERC (CH1)) and dual channel Ethernet Host interface ones (EDMAC (CH0), EDMAC (CH1)).

In detail, please refer to "RX Family Ethernet Module using Firmware Integration Technology [3]" and "RX Family EPTPC Module using Firmware Integration Technology [4]"

1.4 Software Structure

This sample is operations example of the application layer. Those operations are to execute the initialization process, check the INFABT event, receive frames from other nodes, reset hard ware, make frame transfer enable again and so on using the PTP and Ether driver. The PTP driver always should be used with Ether drivers. TCP/IP middle ware does not include in this example. Therefore, user needs to implement TCP/IP middle ware (ex.M3S-T4-Tiny the RX Family [5]) when this example applied to the TCP/IP system. Figure 1.1 shows the software structure of this sample.

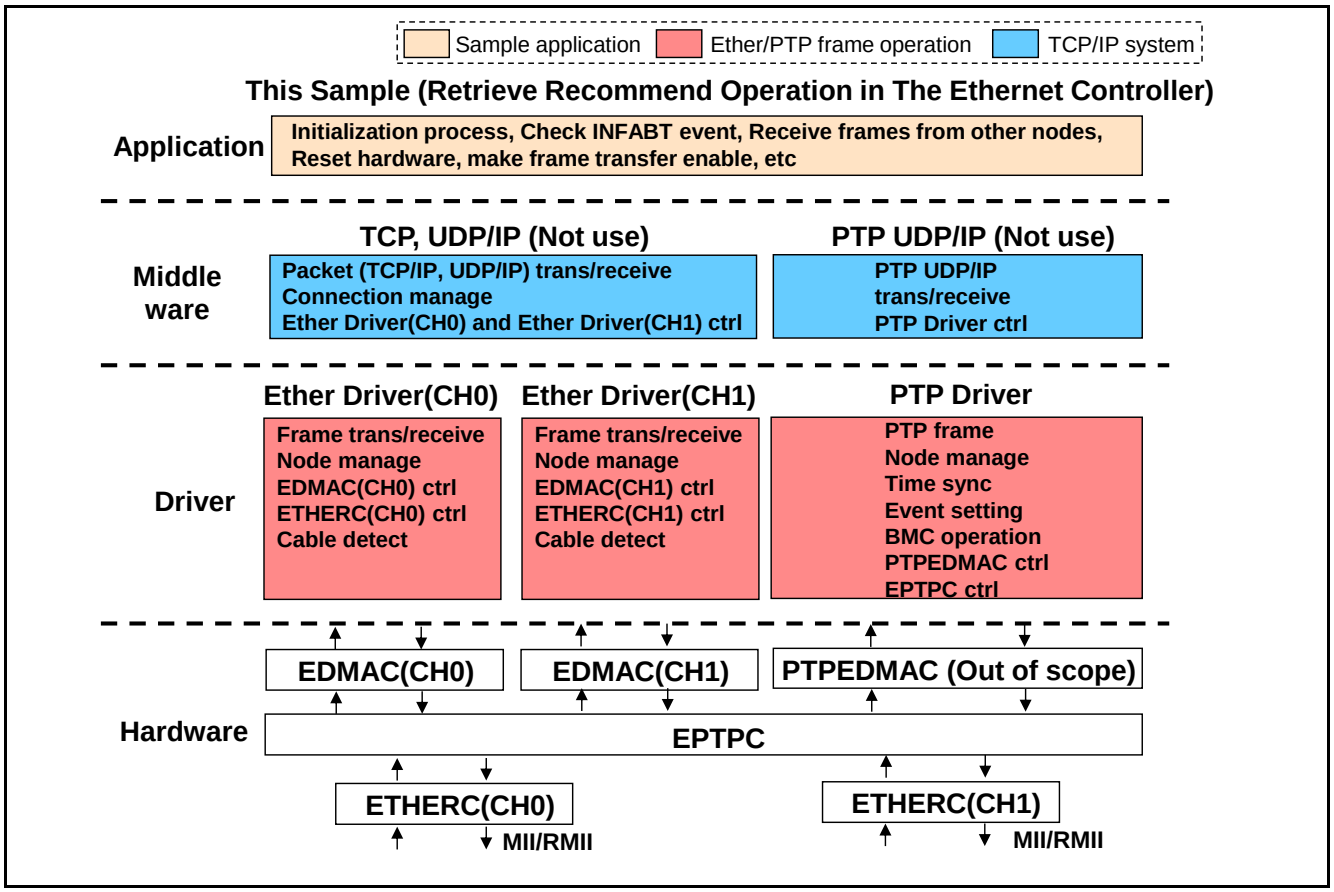

Figure 1.1 Software structure of this sample

1.5 File Structure

This sample codes are stored the “demo_src” and low hierarchical folders. Figure 1.2 shows the source and header file structure of this sample. The FIT based modules (BSP, Ethernet Driver and PTP Driver), please refer to the documentation of the each FIT module.

```
demo_src: sample operation
|   sample_main.c
|
+ --- usr: LED control
|       led.c
|       led.h
|
```

```
r_bsp: BSP (Board Support Package) FIT module
|
r_ether_rx: Ethernet  Driver FIT module
|
r_ptp_rx: PTP Driver  FIT module
|
r_config: configuration setting of FIT modules
|       r_bsp_config.h
|       r_bsp_interrupt_config.h
|       r_ether_rx_config.h
|       r_ptp_rx_config.h
```

Figure 1.2 File structure of this example

2. Functional Information

This example is developed by the following principles.

2.1 Hardware Requirements

This driver requires your MCU supports the following feature:

- EPTPC
- ETHERC
- EDMAC

2.2 Hardware Resource Requirements

This section details the hardware peripherals that this example requires. Unless explicitly stated, these resources must be reserved for the following driver, and the user cannot use them.

2.2.1 EPTPC Channel

The example uses the EPTPC (CH0), EPTPC (CH1) or both depend on the kind of Node. Those resources need to the detection of INFBAT event.

2.2.2 ETHERC Channel

The example uses the ETHEC (CH0), ETHEC (CH1) or both depend on the kind of Node. Those resources need to the Ethernet MAC operations.

2.2.3 EDMAC Channel

The example uses the EDMAC (CH0), EDMAC (CH1) or both depend on the kind of Node. Those resources need to the CPU Host interface of standard Ethernet frame operations.

2.3 Software Requirements

This example is dependent upon the following packages (FIT modules):

- r_bsp
- r_ptp_rx
- r_ether_rx

2.4 Limitations

There are following limitations in this example

- Not support PTP format frames

2.5 Supported Toolchains

This example is tested and works with the following toolchain:

- Renesas RX Toolchain v2.01.00

2.6 Header Files

Each function call is accessed by including a single file, *r_ether_rx_if.h, r_ptpif_rx_if.h, r_ptp_rx_if.h or led.h* which is supplied with this project code.

2.7 Integer Types

This project uses ANSI C99. These types are defined in *stdint.h*.

2.8 Configuration Overview

The configuration options in this example are specified in *sample_main.c* itself. The option names and setting values are listed in the table below.

Configuration options	
#define NUM_OF_CH **- Default value = 1**	Specify the number of using Ethernet channels. - Set 1 or 2 in the RX64M/71M.
#define LINK_CH **- Default value = 1**	Specify the PHY access channel of the ETHERC[1]. - Set 0: when the PHY access channel is 0. - Set 1: when the PHY access channel is 1.
#define RETRY_TIMES **- Default value = 10000**	Specify the Link up wait times.

[1] This setting should be consistent with the RSK board [6] setting (refer to Sec 3.4) and Ethernet driver configuration.

2.9 Data Structures

This section details the data structures that are used with the functions of this example. Those structures are located in *sample_main.c* only as the prototype declarations.

```
/* MAC addresses assigned in this sample (for test usage) */
const static uint8_t my_mac_addr[2][6] =
{ /* 0: CH0, 1: CH1 */
    {0x00,0x01,0x02,0x03,0x04,0x05},
   {0x10,0x11,0x12,0x13,0x14,0x15},
};
```

```
/* Retrieve times, 0:CH0, 1:CH1 */
int32_t g_CntRet[2] = {0,0};
```

```
/* Number of receive frames, 0:CH0, 1:CH1 */
int32_t g_CntRecv[2] = {0,0};
```

```
/* Receive frame buffer */
static int8_t R_BUF[4096];
```

2.10 Return Values

No specific return value exists in this sample.

3. Specification of This Example

3.1 Outline of Functions

The function of this example shows Table 3.1.

Table 3.1 Function of This Example

Item	Contents
main()	Main operation of this example.
EINT_Rcv_isr()	Frame reception interrupt handler.
INFABT_Reset()	Execute close and reset operation after when INFABT event was detected.

3.2 Environment and execution

This example needs the Renesas Starter Kit+ for RX64M (hereafter RX64M RSK board) [6] or the Renesas Starter Kit+ for RX71M (hereafter RX71M RSK board). The outline of the execution sequence is following.

- Connect RX64M/71M RSK board to other devices such as PC, Hub and other communication devices using Ethernet cables.
- Power on the RX64M/71M RSK board.
- When the RX64M/71M RSK board finishes the initialization, driver open and link up process, the user LED composed of LED0, LED1, LED2 and LED3 shows the all-on pattern (LED0: ON, LED1: ON, LED2: ON, LED3: ON).
- The RX64M/71M RSK board waits INFABT interrupt with frame receiving from other devices.
- Every when the RX64M/71M RSK board receives a frame from the other devices, the user LED repeats the even pattern (LED0: ON, LED1: OFF, LED2: ON, LED3: OFF) and the odd pattern (LED0: OFF, LED1: ON, LED2: OFF, LED3: ON) successively. The counter (=g_CntRecv) of each channel to which indicates the received frame times is incremented.
- When the RX64M/71M RSK board detects INFABT interrupt, this example can detect INFABT interrupt refer to NFABT detection flag(=is_INFABT) to which the PTP Driver sets the flag of each channel.
- This example does the following reset operation.

  - Disable interrupt from EPTPC executing the ptp_dev_stop function of the PTP Driver.

  - Close EDMAC and ETHERC of the INFABT interrupt occurrence channel.

  - In case of using two channel, check whether the INFABT interrupt of another channel was occurred or not.

    If it is detected, this sample also close EDMAC and ETHERC of another channel.

  - Reset EPTC executing the R_PTP_Reset function of the PTP Driver.
- The user LED indicates the INFABT occurrence channel following pattern.

  - CH0 pattern: (LED0: ON, LED1: OFF, LED2: OFF, LED3: OFF)

  - CH1 pattern: (LED0: OFF, LED1: ON, LED2: OFF, LED3: OFF)
- The counter (=g_CntRet) of each channel to which indicates the retrieve times is incremented.
- If push the SW1 switch, this example ends after the user LED shows the even pattern (LED0: ON, LED1: OFF, LED2: ON, LED3: OFF).

Figure 3.1 shows one of the environments during this example.

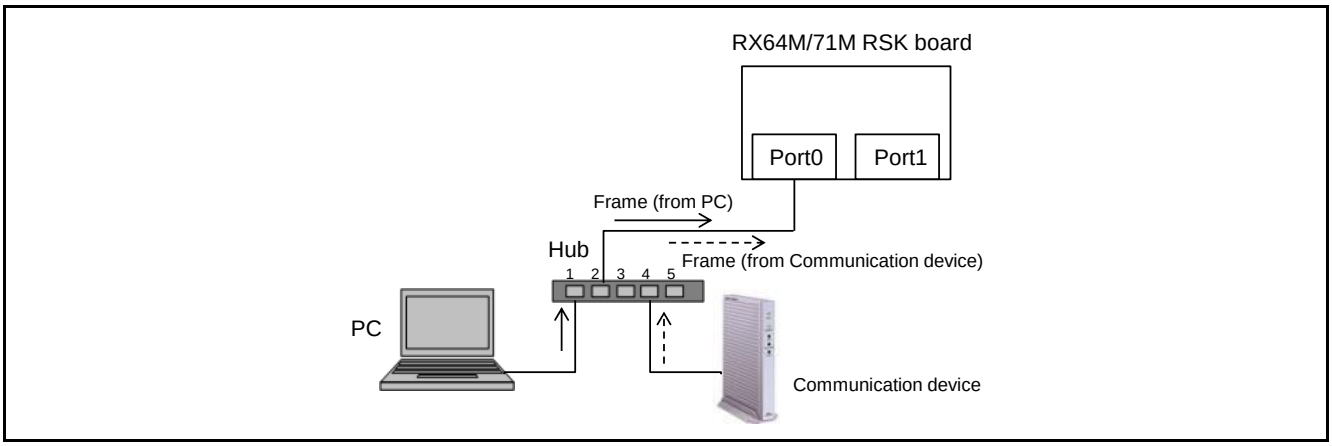

Figure 3.1 Environment

3.3 Recommend Operation

It is recommended to detect INFABT occurrence by interrupt though it occurs only in the singular conditions. Thereafter, it is need to do the retrieve operation.

Figure 3.2, Figure 3.3 and Figure 3.4 show the recommended software flow overview. Figure 3.2 describes the operation to enable detection by interrupt and only related to the Ethernet communication. Figure 3.3 describes the operation executed in the interrupt handler and only related to the INFABT interrupt. In this handler, please execute the retrieve operation explained by the Figure 3.4 and clear the INFABT flag. Figure 3.4 describes the retrieve operation to enable communication same as before INFABT occurrence.

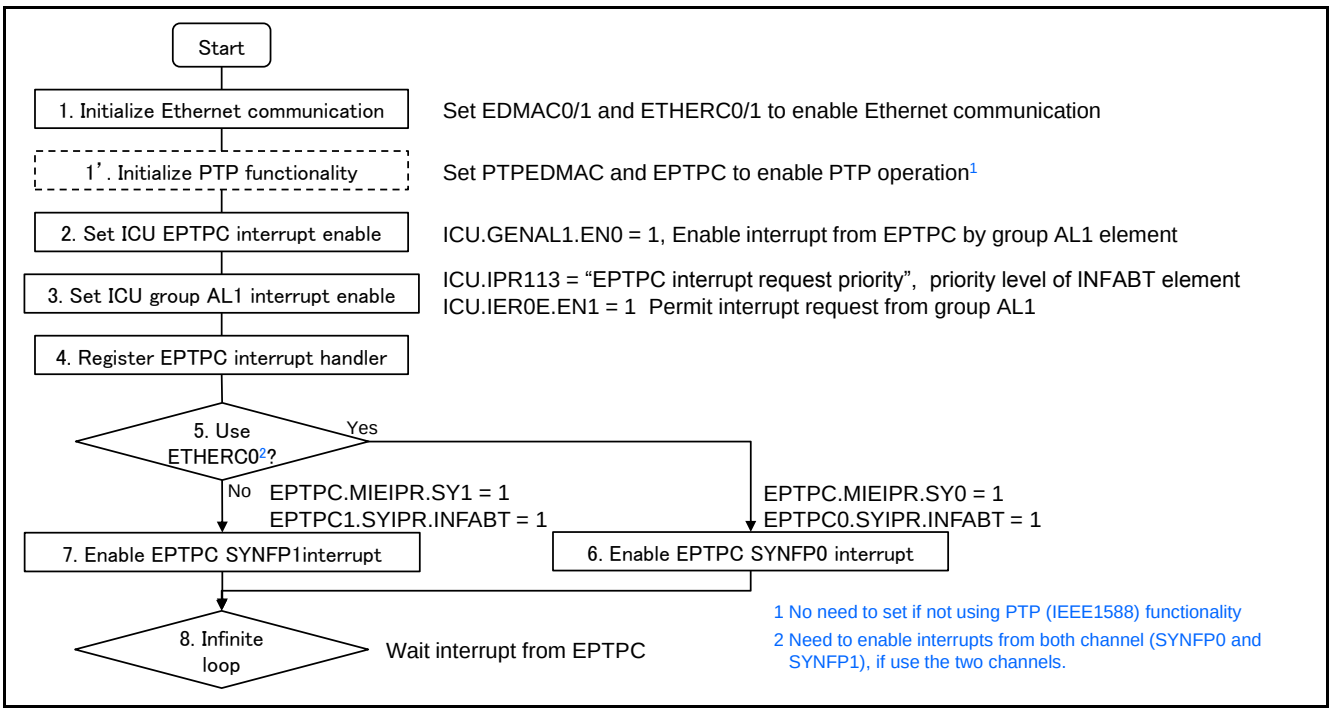
Start
1. Initialize Ethernet communication
Set EDMAC0/1 and ETHERC0/1 to enable Ethernet communication
1'. Initialize PTP functionality
Set PTPEDMAC and EPTPC to enable PTP operation1
2. Set ICU EPTPC interrupt enable
ICU.GENAL1.EN0 = 1, Enable interrupt from EPTPC by group AL1 element
3. Set ICU group AL1 interrupt enable
ICU.IPR113 = "EPTPC interrupt request priority", priority level of INFABT element
ICU.IER0E.EN1 = 1 Permit interrupt request from group AL1
4. Register EPTPC interrupt handler
5. Use ETHERC02?
Yes
No
EPTPC.MIEIPR.SY1 = 1
EPTPC1.SYIPR.INFABT = 1
EPTPC.MIEIPR.SY0 = 1
EPTPC0.SYIPR.INFABT = 1
7. Enable EPTPC SYNFP1interrupt
6. Enable EPTPC SYNFP0 interrupt
8. Infinite loop
Wait interrupt from EPTPC
1 No need to set if not using PTP (IEEE1588) functionality
2 Need to enable interrupts from both channel (SYNFP0 and SYNFP1), if use the two channels.

Figure 3.2 (1) Enable detection by interrupt

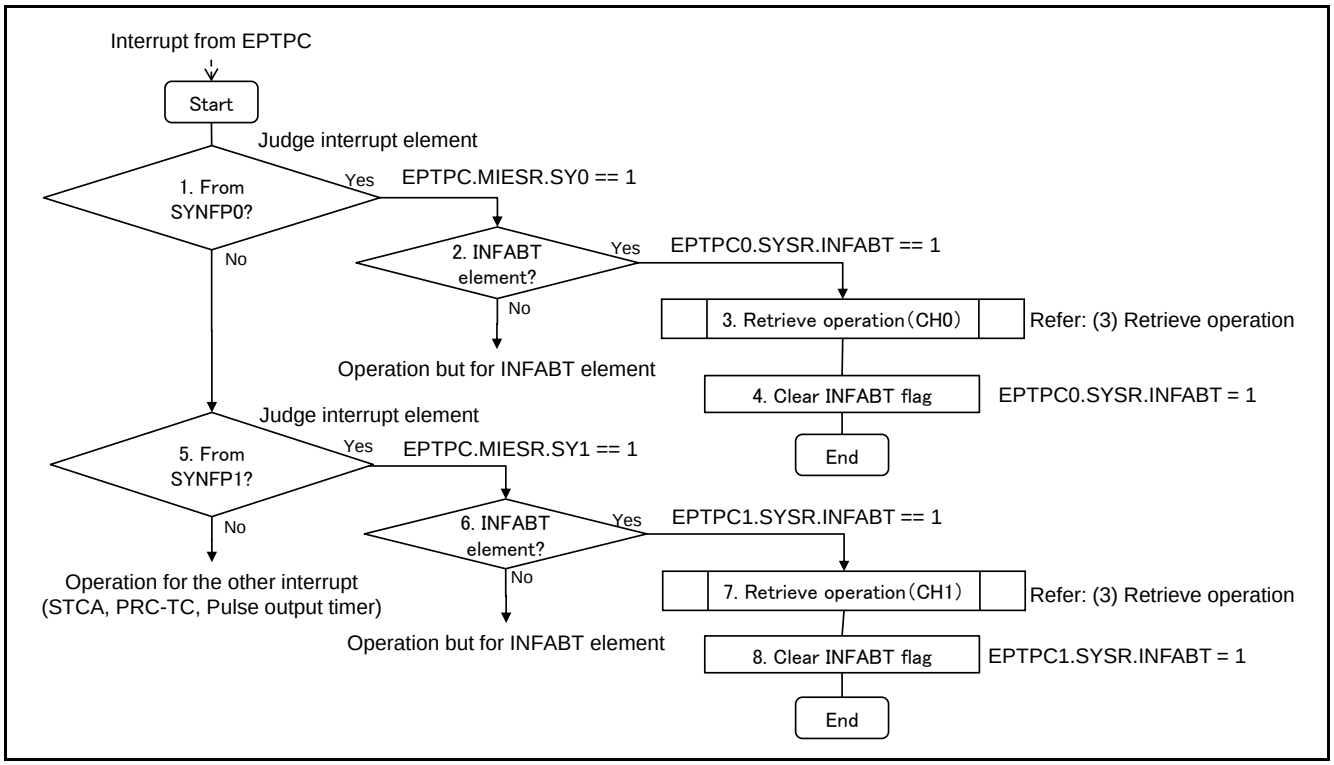

Figure 3.3 (2) Interrupt handler

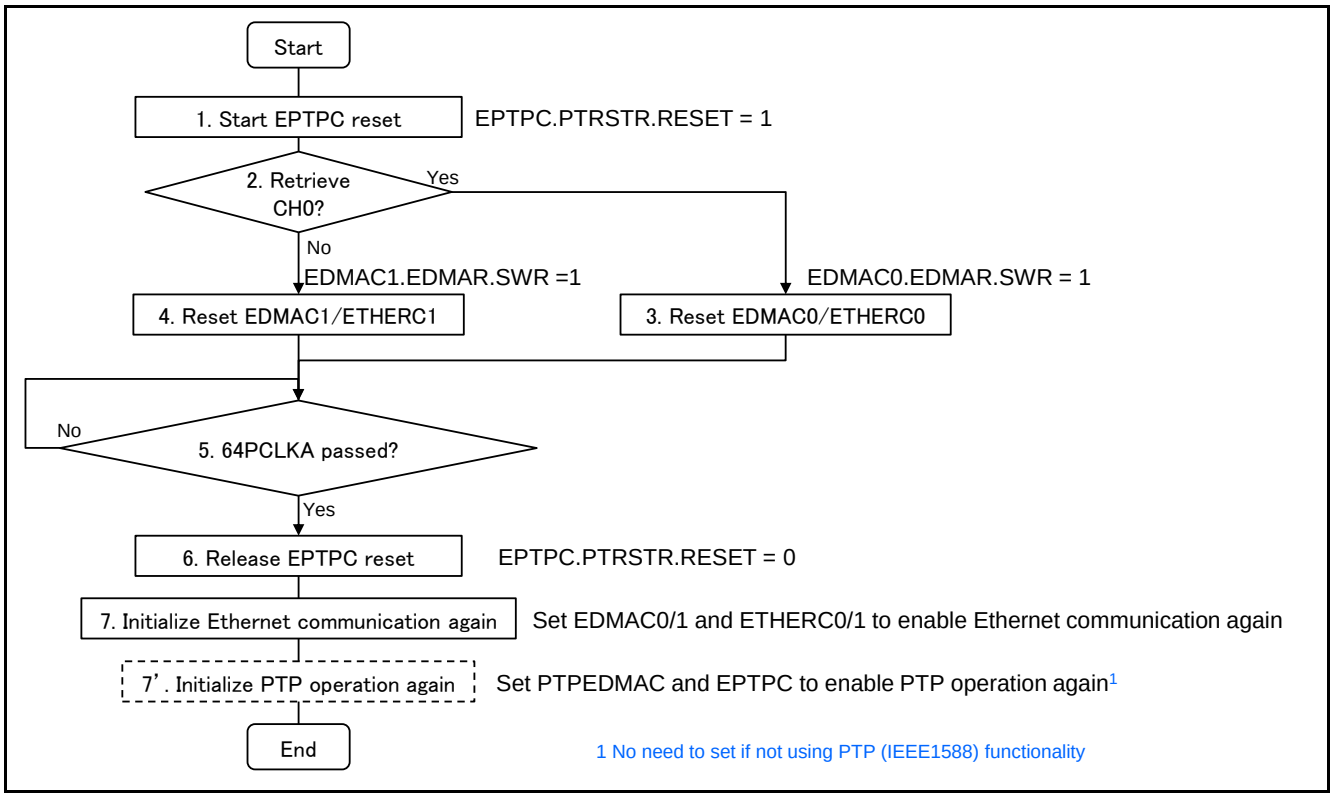

Figure 3.4 (3) Retrieve operation

3.4 Board Setting

There are two jumpers setting of the RX64M/71M RSK board depending on the PHY access channel of the configuration option. When the product name of the RX64M/71M RSK board is R0K50564MC001BR or R0K5RX71MC010BR, Figure 3.5 indicates their changing. And when the product name of the RX71M RSK board is R0K50571MC000BR, Figure 3.6 indicates their changing depending.

Jumper	LINK_CH = 1 (Default setting)	LINK_CH = 0	Functional use
J3	2-3	1-2	ETHERC ET0MDIO or ET1MDIO
J4	2-3	1-2	ETHERC ET0MDC or ET1MDC

Figure 3.5 Jumper setting

Jumper	LINK_CH = 1 (Default setting)	LINK_CH = 0	Functional use
J13	2-3	1-2	ETHERC ET0MDIO or ET1MDIO
J9	2-3	1-2	ETHERC ET0MDC or ET1MDC

Figure 3.6 Jumper setting

4. Reference Documents

User's Manual: Hardware
RX64M Group User's Manual: Hardware Rev.1.00 (R01UH0377EJ)
RX71M Group User's Manual: Hardware Rev.1.00 (R01UH0493EJ)
The latest version can be downloaded from the Renesas Electronics website.

User's Manual: Software
RX Family RXv2 Instruction Set Architecture User's Manual: Hardware Rev.1.00 (R01US0071EJ)
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2. Processing at Power-on

   The state of the product is undefined at the moment when power is supplied.

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